True Precision. PTW.	
Features	
▸ CE marked class IIb certified device	According to the *European Medical Directive (MDD)* an accessory for X-ray equipment is also a medical device. Meanwhile users know about their legal responsibilities and check certification status of medical device accessories.
▸ Compliance with IEC 61674; accuracy ±5%	Some devices show outliers for dose measurements exceeding ± 5% especially at the end of the measuring ranges. Acc. to IEC 61674 the relative uncertainty for air kerma measurements shall not exceed ± 5% within the complete measuring ranges from (23 … 35) kV and (40 … 150) kV. NOMEX fulfils and even exceeds the requirement: RAD/FLU typically ± 1.5 % and MAM ± 2.5 %.
▸ Recommended recalibration every 2 years	Some devices must be send in for recalibration every year. Requiring a recalibration every year points at a bad long-term stability. The energy response (sensitivity) of the device changes, with the result that the calibration factors are not valid and therefore the measuring results are not reliable any more. Moreover requiring a recalibration every is a non negligible cost factor. PTW devices are famous for reliability, reproducibility and their outstanding long-term stability. Recalibration of the NOMEX is recommended only every 2 years.
▸ Fully automatic dose and kV ranging	Some devices require multiple shots before the real measurement can be performed. These *pre-measurements* reveal the device's shortcomings in regards to auto ranging. Based on the implemented fully automatic ranging, multiple exposures for finding the correct dose and/or kV range are avoided when using the NOMEX.
▸ Fully automatic TF compensation	The total filtration (TF) compensation allows the performance of kV measurements without adjusting the device to the existing tube filtration (mm Al). The device identifies the filtration and corrects the kV measurement result accordingly. NOMEX measures the TF within the complete specified measuring range (40 kV … 150 kV) without any exception.
▸ kVp meas. for all appl., ranges & qualities	In contrast to other devices which only allow a kVp detection for a subset of selected radiation qualities, the NOMEX multimeter offers kVpmax, kVpmean and PPV measurements within the complete specified energy range (23 … 35) kV and (40 … 150) kV without exception. NOMEX provides the kV parameters not only for Mo/30µmMo, but also as standard for all mammography qualities: Mo/25µmRh, Mo/0.5mmAl, W/0.7mmAl, W/60µmRh, W/60µmAg and Rh/30µmRh.
▸ PPV calc. acc. to the IEC 61676 algorithm	NOMEX calculates the practical peak voltage (PPV) according to the algorithm described in IEC 61676.

▸ HVL reading for all MAM qualities	NOMEX detects the HVL for all applications including all common mammography radiation qualities (Mo/30µmMo, Mo/25µmRh, Mo/0.5mmAl, W/0.7mmAl, W/60µmRh, W/60µmAg and Rh/30µmRh).
▸ All MAM qualities included as standard	In mammography the NOMEX multimeter comes calibrated ready to be used for all common radiation qualities such as Mo/30µmMo, Mo/25µmRh, Mo/0.5mmAl, W/0.7mmAl, W/60µmRh, W/60µmAg and Rh/30µmRh. Moreover a compression paddle correction factor is provided for each quality.
▸ Usability within the image receiver plane	The NOMEX multimeter fits with 115 mm x 50 mm x 9 mm within the cassette plane. Moreover an optional cassette adapter is available for most convenient use within the image receiver plane.
▸ Angular independence of rotation/orientation	The NOMEX multimeter can be positioned in RAD/FLU/DENT and MAM within the central beam independently of the tube axis orientation. Time-consuming alignments according to the tube axis are absolutely unnecessary.
▸ Full text error messages	Some devices are indicating a measuring result even if it is absolutely wrong. It is then up to the user to decide, whether the result is reliable, poorly or completely wrong. PTW knows what responsibility means, therefore the NOMEX multimeter has a sophisticated error management, which informs the user, about the quality of the measuring result! Poor measuring accuracies are indicated self-evident. Additionally NOMEX suggests what to change within the software settings or within the measurement setup in case of a measuring problem. The user always knows about the measurement quality and what to do in case of an problem.
▸ Firmware updates via internet possible	NOMEX is equipped with a modern boot loader technology. Downloading the latest firmware version via internet within seconds, reduces unnecessary delivery costs and working off times due to long delivery and redelivery periods to a maximum.

For corrections and/or additional information, please contact marketing@ptw.de. All specifications subject to change without notice. Part of D909.199.01/00 2012-05

NOMEX Multimeter

About the NOMEX multimeter

The NOMEX multimeter is a non-invasive miniaturized multi parameter measuring device combining semi-conductor detectors and electronics according to IEC 61674 [1].

With the NOMEX multimeter measurements of the dose, dose rate, dose per pulse, pulses, exposure time, tube voltage (maximum, mean and practical peak), half value layer (HVL) and total filtration (TF) are possible simultaneously in just one single exposure. Additionally the kV and dose rate waveform is logged.

Intended use of NOMEX multimeter

The NOMEX multimeter is used for quality assurance and quality control measurements on medical imaging X-ray installations. Hence the NOMEX multimeter can be used during acceptance tests or routine constancy checks of radiographic, fluoroscopic, dental, CT and mammography X-ray units.

NOMEX multimeter components

The NOMEX multimeter delivery comprises

- NOMEX software
- 2 m USB cable
- 5 m USB active extension cable
- calibration certificate
- user manual
- compact transport case.

Fig. 1 / NOMEX multimeter [L981815]

Optionally available:

- NOMEX multimeter holder for use with a tripod or for fixing via hook-and-loop tape e.g. at dental panoramic units
- NOMEX cassette adapter for use within the image receiver plane
- Mobile PC

Fig. 2 / NOMEX multimeter holder [T20016]

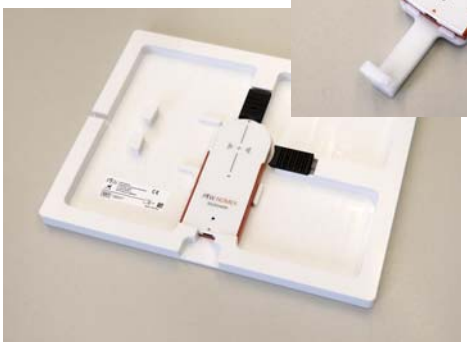


Fig. 3 / NOMEX cassette adapter [T20017]

Comprehensive NOMEX calibration

The NOMEX multimeter is calibrated within the radiography, fluoroscopy, dental, CT and mammography range according to the radiation qualities given by the IEC 61267 [2].

In mammography the NOMEX comes calibrated ready to be used for all common radiation qualities: Mo/25µmRh, Mo/0.5mmAl, W/0.7mmAl, W/60µmRh, W/60µmAg and Rh/30µmRh. Moreover a compression paddle correction factor is provided for each quality.

The NOMEX multimeter factory calibration comprises the calibration of air kerma and air kerma rate (tractable to the PTB), tube voltage (measured by means of a high voltage divider), time, total filtration and half value layer. Due to the worldwide well-known reliability, reproducibility and long-term stability of PTW devices, a recalibration is recommended only every 2 years.

Quick measurement setup

The smart NOMEX multimeter can be directly connected via USB cable to a tablet, netbook or PC running the NOMEX software. No additional and costly accessories (e.g. a sperate display) are required to operate the system.

NOMEX can be positioned within the central beam independently of any consideration of the tube axis alignment, as the ergonomic CE marked class IIb certified meter functions independent of orientation.

Due to its weight and functional affixed rubber pads, NOMEX will not shift after being placed on the patient couch.

For vertical measurements such as on a wall stand the multimeter can easily be attached using the optional NOMEX multimeter holder.

Automatic NOMEX adjustment

NOMEX sets up itself automatically. The following implemented features guarantee a trouble-free workflow:

- **Auto start/stop**
  Measurements start and stop automatically after detection of radiation.

- **Auto dose ranging**
  Dose ranges are set fully automatically, so that annoying and time-consuming double exposures can be avoided.

- **Auto kV ranging**
  kV ranges are set fully automatically. There is no need to adjust the meter to the correct kV range before the measurement.

- **Auto total filtration compensation**
  Within the RAD/FLU/DENT/CT range the adjustment of the X-ray tube filtration is not necessary, based on the implemented total filtration compensation up to 40 mm aluminium.

- **Auto HVL detection**
  For all applications, even for mammography and for all MAM radiation qualities the half value layer (HVL) is determined.

Based on these features, the NOMEX setup simply comprises the following three steps:

Connect …

Fig. 4, 5 / USB connection to any tablet, netbook or laptop

… position …

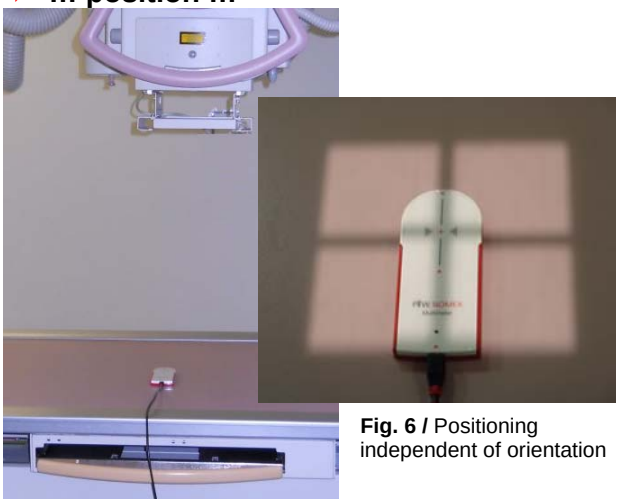


Fig. 6 / Positioning independent of orientation

Fig. 7 / Functional housing avoids shifting

… evaluate.

Fig. 8 / Setup unit and expose

Fig. 9 / Analyze and store data

Time-saving & cost-effective workflow

Within the NOMEX software only the corresponding application (RAD/FLU/DENT, DENT-PAN, CT or MAM) has to be selected. Once the application is selected, no fine-tuning needs to be undertaken before measurement can take place, as NOMEX sets up the rest automatically.

After an exposure, the results will be displayed and listed in a data set chart for further analysis. Additionally the logged voltage or dose rate waveform for each measurement can be viewed. The measured data can be stored, printed, copied or alternatively exported as a XML or CSV file.

NOMEX software features

- The customizable parameter display allows viewing of all parameters at a glance or just specific items of interest:

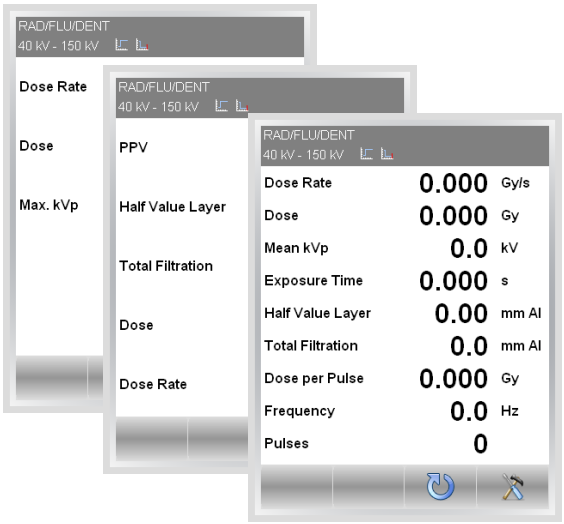
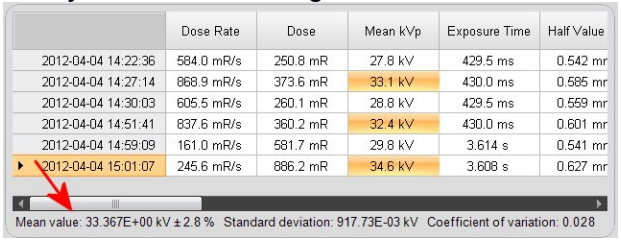


Fig. 10 / Modifiable display and parameter order

- Statistic calculations (mean value, standard deviation, coefficient of variation) by means of marking the results of interest



- Adjustable timer functions (measurement start and stop delays)

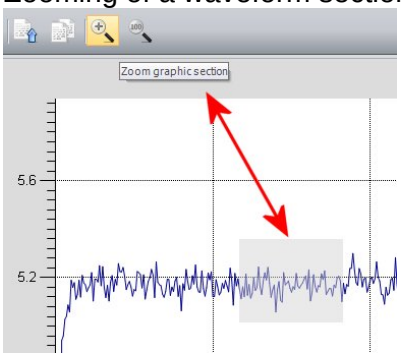
- Adjustable waveform sampling frequency, starting from 3 seconds with full 2.3 kHz up to 60 seconds with 100 Hz

- Possibility to fade in a start/stop button if a manually triggered measurement is required

- Value presentation in technical notation or with unit (optionally in Gray or Roentgen)

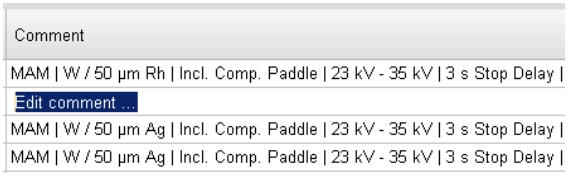
- Data export as XML or CSV file for subsequent processing in Excel or protocol printing as PDF file

- Zooming of a waveform section



- Waveform data export

- Device settings for each measurement are automatically logged and comments can be attached to each measurement



- Snapshot function of the measuring screen for fast attachment to a protocol

- Setup menu available in different languages: Chinese, English, French, German, Italian, Japanese, Portuguese, Russian, Spanish

- Audio signal indicating the availability of a new measurement
- No software licensing, allowing unlimited installations on different PCs for no additional cost
- Sophisticated assistance in case of measuring problems such as dose rate overrange etc.

The NOMEX software combines intuitive operation and coherent data-handling leading to fast, reliable and PTW-like precise results:

Increasing QC efficiency in diagnostic radiology departments NOMEX as an all-round acceptance and service test device is covering all applications and the complete range of measuring tasks: fast, easy and truly precise.

NOMEX - True Precision

The requirements for the performance of dosemeters and semi-conductor detectors as used in X-ray diagnostic imaging are given in the international standard IEC 61674 [1]; those for non-invasive measurements of the X-ray tube voltage in IEC 61676 [3].

The NOMEX accuracy with respect to the parameters dose and dose rate is outstanding and exceeds the requirements of IEC 61674 stated with ± 5 % [1]:

- **Dose accuracy**

The dose accuracy within the complete conventional measuring range from (40 … 150) kV is typically ± 1.5 % and within the mammography range from (23 … 35) kV ± 2.5 %.

- **kV accuracy**

kV accuracy within the conventional measuring range is typically ± 0.75 % or ± 0.5 kV. Additionally PPV measurements in accordance with the algorithm of IEC 61676 [3] are possible.

Summary

International standards and regulations for acceptance and quality control tests of diagnostic X-ray units require the check of a variety of parameters.

NOMEX was designed to measure and to evaluate different quantities in one single operation, making no compromise with respect to the measuring accuracy.

References

[1] IEC 61674: International Electrotechnical Commission. Medical electrical equipment - Dosemeters with ionization chambers and/or semiconductor detectors as used in X-ray diagnostic imaging

[2] IEC 61276: International Electrotechnical Commission. Medical Diagnostic X-ray Equipment - Radiation conditions for use in the determination of characteristics

[3] IEC 61676: International Electrotechnical Commission. Medical electrical equipment - Dosimetric instruments used for the non-invasive measurement of X-ray tube voltage in diagnostic radiology